DEPARTMENT OF THE AIR FORCE

HEADQUARTERS AERONAUTICAL SYSTEMS CENTER (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO

12 MAY 2004

MEMORANDUM FOR: OFFERORS INTERESTED IN PROVIDING COMPLETE CANDIDATES FOR THE PERSONNEL RECOVERY VEHICLE (PRV) PROGRAM

FROM: ASC/LUH
Attn: Mr. David C. Goetz, Contracting Officer
1895 Fifth St, Bldg 46
Wright-Patterson AFB OH 45433-7200

SUBJECT: Personnel Recovery Vehicle (PRV) Request for Information (RFI) #1

1. This is a RFI, not a Request for Proposal. The Government does not intend to award a contract on the basis of this RFI or to otherwise pay for the information requested except as an allowable cost under other contracts as provided in subsection 31.205-18, "...bid and proposal costs," of the Federal Acquisition Regulation. Although "proposal" and "offeror" are used in this RFI, your response will be treated as information only. It shall not be used as a proposal. This RFI is issued for the purpose of conducting market research.

2. Air Force Special Operations Command (AFSOC) is planning to replace the current Combat Search and Rescue (CSAR) platform. The Air Force intends to identify those candidate PRVs that provide opportunity to satisfy currently deficient mission capabilities within the constraints identified in Atch 2. Respondents must currently produce an aircraft similar to the configuration offered. Respondents should provide complete concepts/candidates (weapon system-level, including aircraft systems/subsystems, and support/training systems).

3. A PRV Library is being established at Wright-Patterson AFB to provide access to documents relevant to the CSAR mission. To obtain electronic copies of documents in this library, requestors must provide ASC/LUH with an e-mail or letter identifying the intent to obtain materials from the library. This e-mail/letter must specifically identify the company name, company address, company CAGE code, full name and office phone of requestor. This e-mail/letter must also identify the full name of the person who is authorized to receive the response or sign for the documents if picked-up. If the requestor is qualified for access, the Government will provide these documents through e-mail via sof.prv@wpafb.af.mil.

4. Respond to questions in Atch 3 and complete questionnaire in Atch 4. Responses should be submitted on CD-R in an electronic format that is compatible with Microsoft Windows XP and Office 2002. One CD should be provided to the individual listed in paragraph 5. If the CD contains proprietary/competition sensitive information, the CD and cover label shall be marked "Proprietary/Competition Sensitive Information." Also, four (4) paper copies of the response should be submitted unbound in three-ring binders to the individual listed in paragraph 5 and must be clearly labeled "Proprietary/Competition Sensitive Information" on the cover sheets and in close proximity to this type of information on each applicable page. The paper copies and the

electronic versions must be identical in all respects. Page size shall be 8.5 x 11 inches, not including foldouts. Pages shall be single-spaced. The font size shall be no less than 12 point and use at least 1-inch margins. For page counting purposes, double-sided pages shall be treated as two pages. The maximum RFI response page count shall not exceed 75 pages including the questionnaire at Atch 4.

5. Please provide responses NO LATER THAN 18 June 2004. Send your responses to the following address only. Do not provide classified information as part of your responses.

ASC/LUH
Attn: Mr. David C. Goetz, Contracting Officer
1895 Fifth St, Bldg 46
Wright-Patterson AFB OH 45433-7200

6. In order to help us complete our planning, we request that you provide, by 1 June 2004, a letter indicating your intent to respond to this RFI. Also, please include a one-page description (maximum) of each complete candidate/concept you intend to provide.

7. Any organization or company can obtain PRV Program announcements and instructions via the Web at http://www.pixs.wpafb.af.mil. Questions regarding this RFI should be directed to mailto:sof.prv@wpafb.af.mil.

David C. Goetz

DAVID C. GOETZ
Contracting Officer

Attachments:
1. PRV Library Documents
2. PRV Program Constraints
3. RFI #1 Questions
4. RFI #1 Software Development Questionnaire

Attachment 1

PRV Library Documents

Line No.	Document No.	Title	Date	Classification	Distribution Restrictions	Format(s)
1	PRV ORD	Operational Requirements Document CAF 315-97-B for Personnel Recovery Vehicle (PRV)	Mar-04	Unclassified	FOUO*	MS Word
2	DoD 5000.1	Defense Acquisition	May-03	Unclassified	None	MS Word
3	DoD 5000.2	Mandatory Procedures for Major Defense Acquisition Programs	May-03	Unclassified	None	MS Word
4	DoD Interim Guidebook	Interim Defense Acquisition Guidebook	Oct-02	Unclassified	None	MS Word
5	DoD 5000.4	OSD Cost Analysis Improvement Group (CAIG)	Dec-92	Unclassified	None	PDF
6	DoD 5000.4-M	Cost Analysis Guidance & Procedures	Dec-92	Unclassified	None	PDF
7	CJCSI 3170.01D	Requirement Generation System	Mar-04	Unclassified	A, B, C, J, S	PDF
8	CJCSM 3170-01A	Operation of the Joint Capabilities Integration and Development System	Mar-04	Unclassified	A, B, C, J, S	PDF
9	AFDD 2-1.6	Combat Search and Rescue Operations	Jun-98	Unclassified	None	PDF
10	AFI 10-601	Capabilities Based Operational Requirement	Oct-03	Unclassified	None	PDF
11	AFI 10-602	Operations: Determining Logistics Support & Readiness Requirements	Sep-03	Unclassified	None	PDF
12	AFI 10-1401	Operations: Modernization Planning Documentation	May-95	Unclassified	None	PDF
13	AFI 16-1001	Operations Support: Verification, Validation, and Accreditation	Jun-96	Unclassified	None	PDF
14	AFI 36-2251	Management of Air Force Training Systems	Mar-03	Unclassified	None	PDF
15	AFPD 63-1	Capability-Based Acquisition System	Jul-03	Unclassified	None	PDF
16	AFI 63-101 Interim Guidance	Operation of Capability-Based Acquisition System	Apr 04	Unclassified	None	PDF
17	AFP 63-1701	Program Protection Planning	Mar-03	Unclassified	None	PDF
18	MIL-HDBK-881	Work Breakdown Structure	Jan-98	Unclassified	None	PDF

Line No.	Document No.	Title	Date	Classification	Distribution Restrictions	Format(s)
19	N/A	HH-60G Capabilities Briefing	Mar-04	Unclassified	FOUO*	MS Pwr. Pt.

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Attachment 2

PRV Program Constraints

When determining your response to this RFI, please be aware of the following Government constraints.

1. PRV fleet size

   a. A total of 132 PRVs are required.

   b. For RFI response purposes only, the Phase 1 effort will involve the acquisition of approximately 1/2 of the total PRVs with the attendant training and support capability.

2. Evolutionary Acquisition Strategy

   a. We envision a low-moderate risk evolutionary acquisition and spiral development approach.

   b. Block 0 Initial Operational Capability (IOC) - The war-fighter requires that the first weapon system Block 0 meet or exceed ALL of the Key Performance Parameters (KPPs) in the Operational Requirements Document (ORD) and be at least as capable as the current capabilities of the HH-60G. Refer to the PRV Document library.

   c. The Block 0 design and architecture must support efficient migration to a future block(s). This includes any hardware upgrade required to support enhanced software.

   d. The PRV Block 10 must meet or exceed all ORD Phase 1 thresholds.

   e. During the transition to IOC of the new weapon system and the retirement of the current HH-60Gs, reductions in the current combat capabilities are not acceptable.

3. The current program funding is as shown below. While it may be possible to move money between appropriations in any fiscal year, it is unlikely that total dollar figures for each fiscal year will increase.

	FY05	FY06	FY07	FY08	FY09	To Complete	TOTAL
RDT&E	12.3	138.8	288.8	293.3	328.6	508.0	1569.7
Production					35.5	9371.7	9407.2
TOTAL	12.3	138.8	288.8	293.3	364.1	9879.7	10976.9

4. The contractor should plan to provide all equipment, information, and data as a part of the contract (minimal or no use of Government furnished equipment/information/data (GFE/I/D)).

5. The Government will not provide funding for advanced procurement until contract award.

6. The design, development, testing, production, and sustainment of the PRV will be consistent with rigorous system engineering and system integration methods and principles.

7. PRV must be fully compatible with current and future ground-based, mission planning systems.

8. The PRV contractor will be responsible for the training system.

9. The PRV program will comply with the Berry Amendment (DFARS 252.225-7014).

Attachment 3

RFI #1 Questions

(Note: The Government does not intend to award a contract on the basis of this RFI or to otherwise pay for the information requested except as an allowable cost under other contracts as provided in subsection 31.205-18, Bid and proposal costs, of the Federal Acquisition Regulation. Although "proposal" and "offeror" are used in this Request for Information, your response will be treated as information only. It shall not be used as a proposal. This RFI is issued for the purpose of conducting market research.)

1. Based on the funding profile provided in Atch 2 and a contract award anticipated at FQ1/06, provide a rough-order-of-magnitude (ROM) average unit recurring air vehicle price (Refer to MIL-HDBK-881) of a Phase 1, missionized, Block 0 PRV for a buy of 10 production PRVs, as defined in the ORD, to meet your IOC date. If GFE is a proposed solution assumption, show the total cost of GFE in your cost estimate. It would be beneficial for you to provide a GFE component listing at Work Breakdown Structure (WBS) level 4. Please define which Phase 1 ORD threshold capabilities, if any, are not included by your proposed Block 0 IOC date and when each will be incorporated into the PRV program.

2. Provide your weapon system Level 3 WBS (or more detailed). Cross reference this WBS to the ORD requirements by ORD paragraph. Cross-reference this WBS to aircraft components at the Line Replacement Unit level that you are currently planning to include in your Block 0 approach. Describe which ORD objectives your PRV may achieve in Block 0/Block 10.

3. Assuming a developmental program of 5 test assets (1 structural verification, 1 live fire test and evaluation, 3 flight test to include instrumentation), provide a fiscally phased ROM development cost estimate for Phase 1, Block 0 PRV to a level 3 WBS referring to the ORD as a baseline (Refer to MIL-HDBK-881). Include cost estimating assumptions. If GFE is included in your assumptions, show the total cost of GFE in your cost estimate. It would be beneficial for you to provide a GFE component listing at WBS level 4.

4. Provide a fiscally phased ROM recurring price estimate, including assumptions, to a level 3 WBS referring to the ORD as a baseline (Refer to MIL-HDBK-881) of a Phase 1, missionized, Block 0 PRV for a buy of 10 production PRVs, as defined in the ORD, to meet your IOC date. (It would be beneficial to provide a component listing at WBS level 4.) If GFE is a proposed solution assumption, show the total price of GFE in your price estimate. It would be beneficial for you to provide a GFE component listing at WBS level 4.

5. What is the percentage of the cost of domestic components to the cost of all components to the end product?

6. Based on the information provided in responses to questions 1 through 4 and a contract award anticipated at FQ1/06, provide a top-level, integrated master schedule and projected spend profile by year through development and initial production (10 aircraft/training capability/sustainment capability). As a minimum, include in your top-level schedule the following:

   a. Preliminary design

   b. Critical design

   c. PRV development

      i. Long lead test asset procurement
      ii. Test asset development/production
      iii. Hardware/embedded software procurement
      iv. Software development
      v. Hardware/software/system integration
      vi. Test equipment procurement/Installation
      vii. First flight/Contractor testing
      viii. Projected Government testing

   d. PRV production

      i. Production contract award
      ii. Long lead procurement
      iii. Hardware/embedded software procurement
      iv. Production facility preparation
      v. Production build-up through aircraft 10
      vi. PRV delivery

   e. Training System Component Development

      i. Development Components

         1. Training system requirements analysis
         2. Long lead procurement
         3. Hardware/embedded software procurement
         4. Software development
         5. Hardware/software/system integration
         6. Contractor testing
         7. Projected Government testing

        8. Teardown/shipment to site
        9. Onsite installation and testing
        10. Aircrew Distributed Mission Training (DMT) integration
        11. Initial Cadre Training
    ii. Training System Component Production/Delivery/Acceptance Testing by operational site

f. Logistics Support/Sustainment

    i. Support/test equipment and special tools procurement
    ii. Technical manual development and delivery
    iii. Initial spares procurement and delivery
    iv. Interim Contractor Support (ICS)/Contractor Logistics Support (CLS) and organic support transition

7. Describe your experience with similar systems regarding the following:

    a. Systems produced to date

    b. Current production capacity

    c. Current surge capacity

    d. Planned production and/or capacity

    e. Safety record for both military and civil variants of products with emphasis on mishaps in which causal factors are directly or indirectly related to design deficiencies.

    f. Technical approaches implemented to date addressing critical safety issues such as wire strike protection, vortex ring phenomenon, aircraft survivability, crew emergency egress, downwash and icing conditions.

    g. Qualifications/certifications accomplished to date of products

    h. Reliability, Maintainability and Supportability and risk mitigation of fielded products

    i. Manufacturing percentage of rework and integration of quality

    j. Adapting to new/clarified/updated software requirements.

    k. Developing electronic technical orders in relationship to design, development, test, and delivery

    l. Integrating threat avoidance and threat disengagement to create a survivable PRV system.

m. Implementing logistics support (to include measurement, diagnostic and test equipment documentation, spares, readiness documents) that will enable you to satisfy PRV operational requirements. The Government prefers commonality with other AFSOC equipment including support equipment.

n. Aerial refueling capability

o. Integrating with current AFSOC Mission Planning System (MPS) and DOD Joint MPS

8. Describe all processes that require long lead times or specific long lead funding to implement.
9. Describe all long lead items including time frames and funding required.
10. What is the percentage of commercial items or non-development items envisioned for your proposed PRV and what difficulties have you experienced in obtaining these items?
11. List the re-procurement data that you envision will be available with Government Purpose Rights.
12. Provide your assessment of key technical risk areas in meeting your IOC date and provide recommended tasks and studies that could be undertaken to reduce risk before contract award. Identify your risk reduction activities taking place on other programs that could also reduce risk to the PRV program. Provide related cost and schedule estimates for risk reduction recommendations. Recommend studies/analyses/demonstrations that are not already being funded by the Government that the Government could employ independently to reduce technical risk and validate risk reduction results.
13. Describe your technical and management approach for modifying the Block 0 aircraft and mission systems to satisfy the remainder of the ORD threshold requirements in a Block 10 configuration and identify the timeframe (i.e., have growth capability to transition from Block 0 to Block 10 and meet the ORD threshold requirements). Include in your description how you will manage processing network upgrades required to support enhanced software.
14. List in a matrix form the thresholds and objectives, as defined in the ORD, by year to fulfill ORD requirements and any cost/performance tradeoffs that you recommend to meet your IOC date.
15. Given the capability of your current commercial mission computer software and the projected capability of a mission computer that will be needed to meet all ORD thresholds, describe the technical effort required to modify and integrate all software needed to meet the required ORD capability and provide the cost breakout, by year.
16. Describe your processing network and software architectures and approach to PRV software development, to include reuse of existing software, programming language(s) use, use of prototyping/simulation, configuration management, test approach and status checking, Software Engineering Institute Capability Maturity

Models (CMM)/CMM Integration processes and the development metrics you intend to use. What percentage of the software for PRV is common with other existing platform software?

17. Describe the growth potential remaining in your processing network architecture after delivery of Block 0 and Block 10.

18. Describe the spare capacity that exceeds the ORD thresholds in your design. Provide input to critical areas such as but not limited to: Environmental control system for cabin/flight deck and avionics cooling, engine power, spare capacity for engine accessory power (electrical/hydraulic/pneumatic), cabin reserve (volume and loading), etc.

19. Describe your engineering approach to eliminate single point failures and provide a fail safe design.

20. Describe your engineering approach to minimize limitations on avionics operation with regard to cold weather startup, hot weather operation, hot and cold storage. (Related to thermal issues on equipment containing liquid crystal display technology.)

21. Describe your process in identifying, tracking and resolving safety and health hazards.

22. Describe your approach to minimize crew member, pararescue jumper (PJ), and maintainer workload and optimize the crew station design. What additional responsibilities will you foresee being placed upon the crew members, PJs, or maintainers as compared to the current rescue vehicle? What systems will require a significant amount of automation to meet this workload distribution?

23. Describe your approach to satisfying the combat radius KPP defined in ORD paragraph 4.1.1.2 relative to your IOC date.

24. Describe your approach to providing safe operations for recovery team/injured and uninjured isolated personnel defined in ORD paragraph 4.1.1.7 relative to your IOC date. Describe PRV performance characteristics to include hover limitations and downwash characteristics for rescue operations (altitude IGE and OGE, surface conditions, terrain slope, and instrument meteorological conditions).

25. Describe your approach to satisfying the Interoperability KPP defined in ORD paragraph 4.2 relative to your IOC date.

26. Describe your approach to satisfying the deployability KPP defined in ORD paragraph 4.3.3.1 relative to your IOC date.

27. Describe your approach to provide the ORD threshold lethal and non-lethal threat suppression.

28. Describe your design approach for minimizing cabin contamination (to include saltwater intrusion). Provide your proposed approach to decontamination and corrosion control.

Attachment 4

RFI #1 Software Development Questionnaire

(Reference SEER-SEM: Software Estimation, Planning and Project Control User's Manual, Galorath Inc.)

(Note: The Government does not intend to award a contract on the basis of this RFI or to otherwise pay for the information requested except as an allowable cost under other contracts as provided in subsection 31.205-18, Bid and proposal costs, of the Federal Acquisition Regulation. Although "proposal" and "offeror" are used in this Request for Information, your response will be treated as information only. It shall not be used as a proposal. This RFI is issued for the purpose of conducting market research.)

1. Identify software development method: Rapid application development, traditional waterfall, object-oriented, spiral, or incremental

2. For each programming language, provide the following information for **Block 0** software development:

   a. Identify the least/minimum number of new lines of code, the likely number of new lines of code, and the upper most number of new lines of code.

   b. For existing lines of code, designed for reuse, identify the least/minimum number of lines of code, the likely number of lines of code, and the upper most number of lines of code.

   c. For existing lines of code, not designed for reuse, fill out the following table:

	Least	Likely	Most
Pre-existing lines of code			
Lines to be deleted in pre-existing			
Redesign required			
Reimplementation required			
Retest required			

2. For each programming language, provide the following information for **Block 10** software development:

   a. Identify the least/minimum number of new lines of code, the likely number of new lines of code, and the upper most number of new lines of code.

   b. For existing lines of code, designed for reuse, identify the least/minimum number of lines of code, the likely number of lines of code, and the upper most number of lines of code.

   c. For existing lines of code, not designed for reuse, fill out the following table:

	Least	Likely	Most
Pre-existing lines of code			
Lines to be deleted in pre-existing			
Redesign required			
Reimplementation required			
Retest required			

Definitions:

Lines of Code (LOC): A non-comment, executable software source instruction. Do not include comments and blanks, begin statements, code continued on separate lines, machine/library generated statements, and non-final test code or debug statements.

Pre-existing lines of code: Number of effective lines of reused code.

Lines to be deleted in pre-existing: Estimate the number of LOC that will be deleted outright from the estimated number of reused lines before any work begins.

Redesign required: Percentage of existing software that must be redesigned to make the reused software functional or estimate the changes to the overall design or system architecture that will be required to reuse the existing design.

Reimplementation required: Percentage of existing software that must be re-implemented (coded and tested at the unit level) to make the reused software functional.

Retest required: Percentage of existing software that requires testing (integration testing, component testing, and system testing) to ensure the software functions within performance, reliability, and other criteria after the changes.

3. Respond to the following questionnaire regarding your software development:

    a. Programming capabilities & experience

        i. Analyst capabilities: Rate the analyst team (not individuals). Analysts include personnel developing software requirements and specifications and preparing high-level software design.

            1. Very High – Near perfect functioning team (90th percentile)
            2. High – Extraordinary (75th percentile)
            3. Nominal – Functional and effective (55th percentile)
            4. Low – Functional with low effectiveness (35th percentile)
            5. Very Low – Poorly functioning team (15th percentile)
            6. Very Low- -- Nonfunctional team (5th percentile)

ii. Analyst's application experience: Rate the analyst team's relevant experience in designing with similar applications.

1. Very High – 10+ years or reimplementation by the same team
2. High – 6 years average
3. Nominal – 3 years average
4. Low – 1 year average
5. Very Low – Less than 4 months average

iii. Programmer capabilities: Rate the programming team assigned that performs "code to" detailed design, write code, and prepare and run initial unit test cases.

1. Very High – Near perfect functioning team (90th percentile)
2. High – Extraordinary (75th percentile)
3. Nominal – Functional and effective (55th percentile)
4. Low – Functional with low effectiveness (35th percentile)
5. Very Low – Poorly functioning team (15th percentile)
6. Very Low- -- Nonfunctional team (5th percentile)

iv. Programmer's language experience: Rate the programming team's average experience with the programming language or implementation mechanism being used.

1. Extra High – 4 years average
2. Very High – 3 years average
3. High – 2 years average
4. Nominal – 1 year average
5. Low – 4 months average
6. Very Low – Less than 4 months average

b. Development system experience: Rate the development team's average years of experience with the development system, the combination of hardware, operating systems, job control languages, and all the things the developers will use to develop the software.

i. Extra High – 4 years average

ii. Very High – 3 years average

iii. High – 2 years average

iv. Nominal – 1 year average

v. Low – 4 months average

vi. Very Low – Less than 4 months average

c. Target system experience: Rate the average years of experience the development team has with the target (final) system on which the software product under estimation will execute, including both the hardware environment and the resident operating system, if any.

i. Extra High – 4 years average

ii. Very High – 3 years average

    iii. High – 2 years average
    iv. Nominal – 1 year average
    v. Low – 4 months average
    vi. Very Low – Less than 4 months average

d. Practices & methods experience: Rate the average number of years the team will have with the software practices and methods that will be used. Software practices are those processes, methods, and tools that establish the managerial and technical environment in which software products are developed (e.g., design reviews, quality assurance activities, software engineering methods)
    i. Extra High – 4 years average
    ii. Very High – 3 years average
    iii. High – 2 years average
    iv. Nominal – 1 year average
    v. Low – 4 months average
    vi. Very Low – Less than 4 months average

e. Modern development practices use: Rate the usage of modern software development practices and methods at the time the software design begins. These include analysis and design, structured or object-oriented methods, development practices for code implementation, documentation, verification and validation, and product baseline control. Only successful incorporation of practices as standard procedures within the organization as well as by this team count as full use.
    i. Very High – Routine use of a complete software development process, SEI level 3 or above
    ii. High – Reasonably experienced in most practices, SEI level 2 or above
    iii. Nominal – Reasonably experienced in some practices
    iv. Low – Beginning experimental use of practices
    v. Very Low – No use of modern development practices

f. Automated tools use: Rate the degree to which the software development practices have been automated and will be used on this development. When rating this, consider tool use across all aspects of the software development process, not just programming tools.
    i. Very High – Advanced full integrated tool set (integrated CASE, full Ada APSE)
    ii. High+ -- Modern fully automated application development environment, including requirements, design, and test analyzers
    iii. High – Modern visual programming tools, automated CM, test analyzers plus requirements or design tools
    iv. Nominal+ -- Visual programming, CM tools and simple test tools
    v. Nominal – Interactive, programmer work bench (Ada minimal APSE)

vi. Low – Base batch tools (compiler, editor)
vii. Very Low – Primitive tools (bit switches, dumps)

g. Logon through hardcopy turnaround: Rate the computer response time experienced by the project team. This time should include the total time in hours for the following: Log on system, start program editor, open and save a source file, compile & link source code, execute compiled code, and obtain a copy of the program output at the developer's desk. One hundred percent access to the development resources is assumed.
   i. Very high – Turnaround 8 hours
   ii. High – Turnaround 4 hours
   iii. Nominal – Turnaround 2 hours
   iv. Low – Turnaround 30 minutes
   v. Very Low – turnaround less than 6 minutes

h. Terminal response time: Rate the average transaction response time from the time a developer presses a key until that key is acknowledged and its action is completed.
   i. Extra High -- >3seconds
   ii. Very High – 2 seconds
   iii. High – 1 second
   iv. Nominal -- .5 seconds
   v. Low -- <.25 second

i. Multiple site development: Rate the organizational and site diversity within the personnel developing the software. Anything that would isolate one part of the development team from another should be considered. A program being developed in a mixed security level environment should be considered as multiple organizations.
   i. Extra High – Multiple sites, located 50 miles or more from each other, or international participation
   ii. Very High – Multiple sites, same general location, or mixed clearance levels
   iii. High – Singe site & multiple organizations
   iv. Nominal – Single site & single organization

j. Resource dedication: rate the availability of the development and target machines to the development organization.
   i. Nominal – 100% FULL DEDICATED computing resources
   ii. Low – 70% access computing resources
   iii. Very Low – 40% access computing resources
   iv. Very Low- -- 10% access computing resources

k. Resource and support location: Rate the degree of access to development resources and support, such as system consultants, programming language support, and development tool support.

i. Extra High – 400 miles radius or greater or more than a day
ii. Very High – 200 mile radius or 5 hours
iii. High – 50 mile radius or 1.5 hours
iv. Nominal – Local development resources and support

l. Development system volatility: rate the difficulty caused by changes to the development system. These may be changes in the program editors, compilers or other tools, changes in the operating system and command languages, or changes in the development hardware itself.
i. Extra High – Major change every 2 weeks, minor 2 times a week
ii. Very High – Major change every 2 months, minor each week
iii. High – Major change every 6 months, minor every 2 weeks
iv. Nominal – Major change every 12 months, minor each month
v. Low – No major changes, minor change each year

m. Process volatility: This is the frequency of changes to the processes, methods and tools that establish the managerial and technical environment in which software products are developed. A minor change would have some impact on the develop team, but would not require significant adjustments to the way in which they work. A major change would require a significant adjustment in the way in which the development team works, and would have a noticeable impact on the development effort.
i. Extra High – Major change every 2 weeks, minor 2 times a week
ii. Very High – Major change every 2 months, minor each week
iii. High – Major change every 6 months, minor every 2 weeks
iv. Nominal – Major change every 12 months, minor each month
v. Low – No major changes, minor change each year

n. Requirements volatility: Rate the anticipated frequency and scope of change in the requirements once they are baselined. Requirements from customers are often inadequate for software development since the customer may not have the ability to define the requirements with the level of detail needed by the developer. Detailed software requirements may change while system-level requirements stay the same.
i. Extra High – Frequent major changes
ii. Very High – Frequent moderate & occasional major changes
iii. High+ -- Evolutionary software development with significant user interface requirements
iv. High – Occasional moderate redirections, typical for evolutionary software developments
v. Nominal – Small non-critical redirections
vi. Low – Essentially no requirements changes

o. Specification level-reliability: rate the level of development specification required. This refers to software engineering-level documentation.

i. Very High – Documentation is required for all aspects of system development, including architecture, design, programming, and interface specifications.
ii. High – Typical Mil-Specs or other standards with full documentation. Documentation usually is delivered with the software system.
iii. Nominal -- Typical Mil-Spec or other standards tailored to include complete essential documentation.
iv. Low – Minimal documentation.
v. Very Low – Documentation is not dictated or required

p. Test level: Rate the rigor and formality of the software testing. The test level is based on the potential for loss if the software malfunctions during operation.
   i. Very High – Rigorous, formal testing, following prescribed plans, procedures, and reporting to ensure the highest reliability
   ii. High – Complete formal testing procedures, reporting and approval of test results. Major retest of unchanged functionality.
   iii. Nominal – Informal testing.
   iv. Very Low – Testing is minimal and doesn't follow any prescribed procedures or processes.

q. Quality assurance level: Evaluate the completeness of the quality assurance activities.
   i. Very High -- Rigorous, formal quality assurance, following prescribed plans, procedures and reporting to ensure the highest reliability.
   ii. High – Formal quality assurance activities, quality engineering, quality management.
   iii. Nominal – Formal quality assurance.
   iv. Low – Informal quality assurance.
   v. Very Low – no specific quality assurance activities, any quality assurance performed is incidental to the development.

r. Rehost from development to target: Rates the effort to convert the software from the development system to the target system on which the software will execute.
   i. Extra High – Major language and system change
   ii. Very High – Major language or system change
   iii. High – Minor language and system change
   iv. Nominal – No rehosting, same language & system

s. Reusability level required: rate the requirements for producing software that is designed to be reusable within other programs. Reusable code is full reusable "as is" with no modifications.

i. Extra High – Mission software developed with full reusability required. All components of the software must be reusable. Reusability is a primary objective of the development organization.
ii. Very High – Software will be reused within a single product line
iii. High – Software will be reused within a single application area
iv. Nominal – No reusability requirement

t. Software impacted by reuse: Rate the amount of the software under development that is required to be reusable.
   i. 100% reusable
   ii. 50% reusable
   iii. 25% reusable
   iv. 0% reusable

u. Language type: Rate the difficulty of the programming language(s) used within the development.
   i. Very High – Full Ada, PL/1 Version F
   ii. High – JOVIAL, CMS-2, Mainframe assemblers
   iii. Nominal – C++, C, COBOL, Java, Pascal, FORTRAN, PL/1 Subset G, PC Basic, micro assemblers, Ada without tasking
   iv. Low – Basic, Many 4GLs

v. Development system complexity: Rate the relative complexity of the development system, compilers, JCL, file interfaces, and support environment.
   i. High – Distributed network where developers must have cognizance of the distributed functionality
   ii. Nominal – Multi-user systems (NT server, VAX VMS, UNIX)
   iii. Low – Single user machines, stand-alone systems, may be networked.

w. Application class complexity: Rate the overall level of application difficulty in terms roughly of the years of study or experience required to become nominally proficient in a specific application in the application class.
   i. High – Networks, operating systems, compilers, fire control systems
   ii. Nominal – Applications with complex systems or complex file or user interfaces, such as client-server systems, command and control, communication networks and systems
   iii. Low – Business data processing applications, interface systems

x. Process improvements: Evaluate the impact of improving development technology by comparing current, established development practices with those planned for this development.

i. Extra High – Extreme change – organization improving development technologies (any 2-level jump in SEI CMM rating)

ii. Very High – Major change – organization improving rating (moving from SEI CMM level 1 to 2; implementing ISO)

iii. High – Moderate change – organization improving development technologies (any 1-level jump from SEI CMM level 2 or above)

iv. Nominal – No change in modern development practices or SEI CMM rating

y. Special display requirements: Rate the amount of effort required to implement user interface display interaction involved with this program.

i. Extra High – Complex: CAD/CAM, 3D solid modeling

ii. Very High – Interactive: light pen, mouse, touch screen, windows etc. controlled by the software being developed

iii. High – User Friendly: error recovery and menus, basic Windows GUI not controlled by the application

iv. Nominal – Simple inputs/outputs: batch programs

z. Memory constraints: Rate anticipated effort by developers to reduce memory usage. No memory constrains exist, even when the available memory is 99% utilized, if no conservation action is required by the development to conserve memory.

i. Extra High – Complex memory management and economic measures

ii. Very High – Extensive overlaying or segmentation

iii. High – Some overlaying or segmentation

iv. Nominal – No memory constraints

aa. Time constraints: Rate the percentage of software that must have specific coding effort to enhance timing performance.

i. Extra High – 75% of code is time constrained

ii. Very High – 50% of code is time constrained

iii. High – 25% of code is time constrained

iv. Nominal – No time constraints

bb. Real time code: Rate the amount of software involved in real-time functions

i. Extra High – 100% of source lines with real-time considerations

ii. Very High – 50% of source lines with real-time considerations

iii. High -- 25% of source lines with real-time considerations

iv. Nominal -- 0% of source lines with real-time considerations

cc. Target system complexity: Rate the level of complication of the target operating systems, compilers, controllers and other attached processors the developer must be familiar with to perform the development task.

i. High – Distributed network target where developers must have cognizance of the distributed functionality
ii. Nominal – Multi-user target systems (NT Server, VAX VMS, UNIX)
iii. Low – Single user target machines, stand-alone systems, may be networked

dd. Target system volatility: Determine the difficulty caused by changed to the target system. These may be changes in the program editors, compilers, or other tools, changes in the command languages, or changes in the target hardware.
i. Extra High – Major change every 2 weeks, minor 2 times a week
ii. Very High -- Major change every 2 months, minor each week
iii. High – Major change every 6 months, minor every 2 weeks
iv. Nominal – Major change every 12 months, minor each month
v. Low – No major changes, minor change each year

ee. Security requirements: Rate development impact of security requirements for the delivered target system. Rate special work to be performed during this stand-alone program development only.
i. Extra High+ -- Class A1: Security formally verified by mathematical proof
ii. Very High – Class B3: System excludes code not essential to security enforcement. Audit capability is strengthened. System almost completely resistant to penetration
iii. High+ -- Class B1: In addition to C2, data labeling and mandatory access control are present. Flaws identified by testing are removed.
iv. High- -- Class C2: users individually accountable via logon operations, auditing of security relevant events and resource isolation.
v. Nominal+ -- Class C1: Access limited. Based on systems controls accountable to individual user or groups of users. Simple project-specific password protection.
vi. Nominal – Class D: Minimal protection – no security.

ff. Programs concurrently integrating: Number of computer programs that will be integrated with this program. Count only programs with which this program must interface directly. This number will determine how much software-to-software systems integration and testing is required. Scale is 3% per program.
i. Extra High – 24%
ii. Very High – 9%
iii. High – 6%
iv. Nominal+ -- 3%
v. Nominal – 0%

gg. Concurrency of integration & test: Rate the degree of concurrency or overlap between the development activities and the integration and testing activities.

i. Extra High – All systems integration will occur during development. The product will be fully integrated and tested with the system when delivered.
ii. Very High – the majority of system integration will occur during development before testing is complete.
iii. High – System integration begins during software integration testing.
iv. Nominal – System integration occurs after software WBS elements are completely tested individually

hh. Hardware integration level: Rate the difficulty of integrating the software with the operational or target hardware. Percentage is amount of effort added to the estimate for hardware integration.

i. Very High – Significant integration with hardware, concurrent hardware development (32%)
ii. High – Significant integration with hardware, some custom hardware in the configuration (28%)
iii. Nominal – Same type hardware, different configuration (22%)
iv. Low – Same system or commercial-off-the-shelf hardware (16%)
v. Very Low – No hardware integration (0%)